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Fugitive Dust Emission Inventory, Wasatch, Utah

PEDCo-Environmental Specialists, Inc Cincinnati, Ohio

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FUGITIVE DUST EMISSION INVENTORY WASATCH FRONT, UTAH

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
AIR & HAZARDOUS MATERIALS DIVISION
DENVER, COLORADO 80203

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This report contains emission estimates for fugitive dust sources of air pollution in Wasatch Front, Utah. Estimates for particulate emissions are made for the base year (1974), 1980 and 1985. Methodologies and data sources are presented.

17. KEY WORDS AND DOCUMENT ANALYSIS

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Material included in this report was not originally intended for publication, but to document the data sources and assumptions made in preparing the area source emission inventory. Therefore, the text may be sketchy and the report more useful as a resource document than a general procedures manual for emission inventories. It should also be pointed out that the area source emission inventory is subject to frequent updating so that data presented herein may soon become obsolete.

Publication No. EPA-908/1-76-001

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1. SUMMARY

This report presents the results of a fugitive dust emission inventory conducted for Utah's Wasatch Front, which nearly coincides with the Salt Lake City Air Quality Maintenance Area* (AQMA). The inventory was performed to provide information to the Utah Bureau of Air Quality in their assessment of the ability of the Utah State Implementation Plan to maintain the particulate ambient air quality standards in this area. Air quality levels and emissions of total suspended particulate (TSP) indicate this area to be the only possible AQMA in Utah which may not currently meet ambient air quality standards.

The inventory is primarily based on 1974 data, and projections for 1980 and 1985 have also been made where possible. It completes the particulate emission inventory[1] conducted by GCA for the National Emissions Data System for Utah in 1973. The inventory overlaps the GCA inventory in

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*The modified Salt Lake City AQMA now includes Salt Lake County, which makes the boundary identical to the Governor's proposed 208 planning area.

[1] State of Utah Compilation of NEDS Data. Prepared for U.S. EPA Region VIII, Contract No. 68-02-1006, Task No. 2. GCA/Tchnology Division. December 1973.

four NEDS area source categories -- unpaved roads, building construction (industrial, commercial, institutional, and residential), highway construction, and rock handling and storage. This inventory is believed to be more accurate in these overlapping categories because of the additional detail employed.

The study area is comprised of Salt Lake, Utah, Davis, and Weber counties and portions of the bordering counties of Tooele, Juab, and Millard, which have fugitive dust sources which impact the Wasatch Front. Figure 1-1 illustrates this study area.

A summary of the results of the fugitive dust inventory is presented by source category in Table 1-1, while Figure 1-2 illustrates their relative contribution to the total fugitive dust emissions generated. As shown, residential/commercial/industrial construction activities and unpaved roads are the major fugitive dust sources in this area.

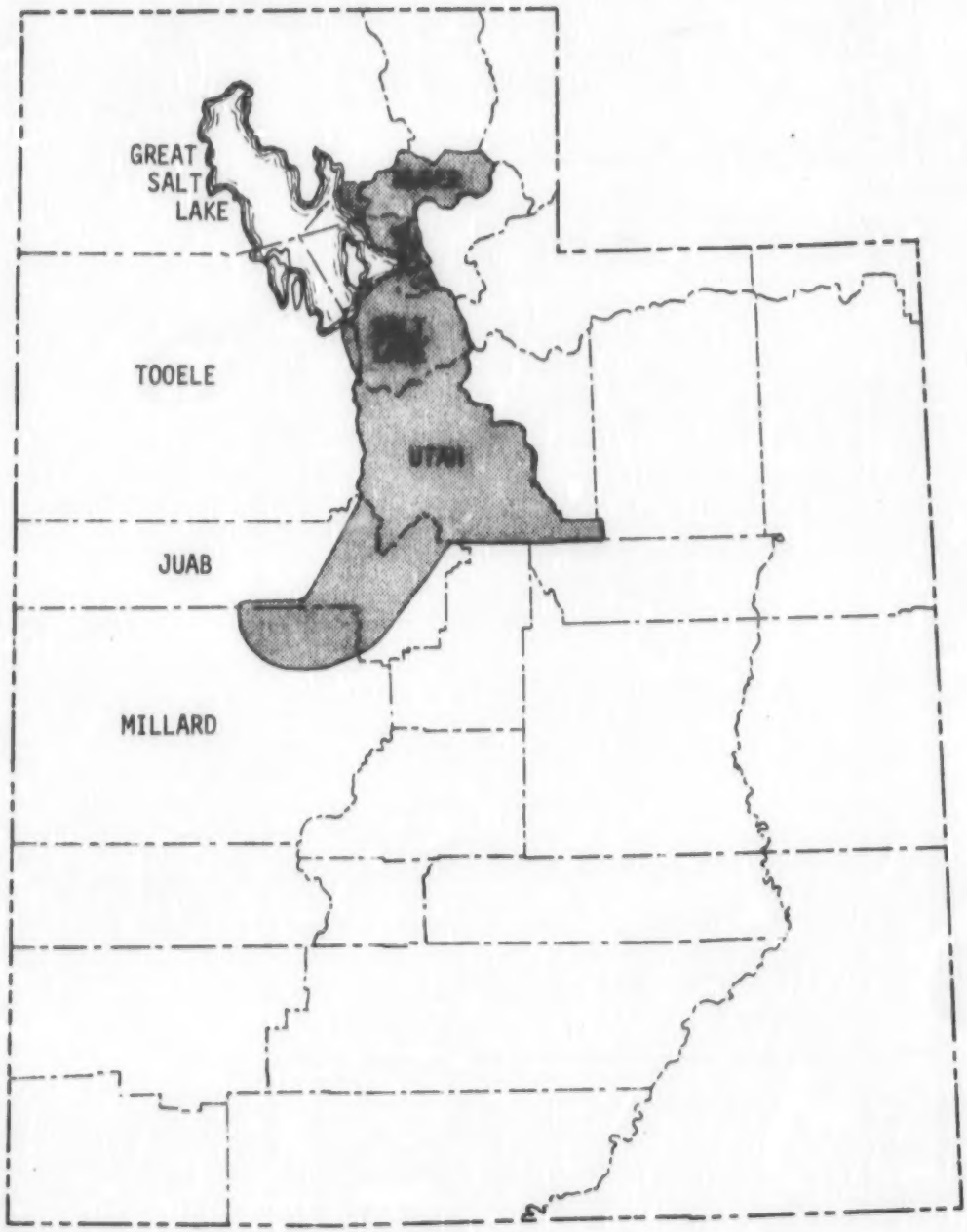


Figure 1-1. Location of Wasatch Front study area - State of Utah.

Table 1-1. UTAH FUGITIVE DUST EMISSIONS INVENTORY

(tons/year)

Source category	Weber	Davis	Salt Lake	Utah	Tooele (partial)	Juab (partial)	Millard (partial)	Region total
Agriculture								
Wind blown	41	136	74	126	10	49	230	666
Tilling	6	6	16	19	5	12	8	72
Unpaved roads	454	697	2190	2690	37	187	315	6570
Tailings	Neg.	Neg.	2781	Neg.	41	3	6	2831
Aggregate storage	329	249	1576	581	Neg.	Neg.	Neg.	2735
Industrial storage	Neg.	Neg.	Neg.	22	Neg.	Neg.	Neg.	22
Road construction	245	Neg.	1625	26	Neg.	1442	Neg.	3338
Residential/commercial/industrial construction	372	546	10593	906	Neg.	Neg.	Neg.	12417
Sanding (ice & snow control)	743	453	2694	958	Neg.	Neg.	Neg.	4848
County total	2190	2087	21549	5328	93	1693	559	33499

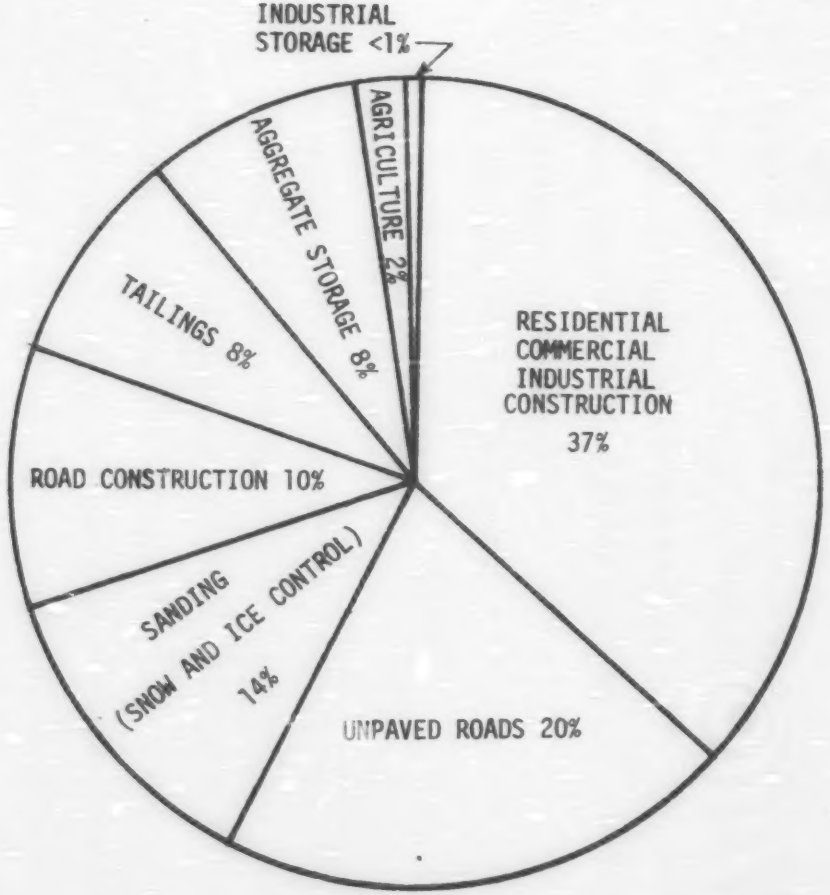


Figure 1-2. Graphic representation of relative contributions of individual source categories to total Wasatch Front study area fugitive dust emissions.

2. METHODOLOGY

INTRODUCTION

The fugitive dust categories surveyed include agriculture, unpaved roads, tailings, aggregate storage, industrial storage, highway construction, residential-commercial/industrial construction, and sanding (ice and snow control). Sources initially considered, but subsequently determined to be relatively insignificant, were cattle feed lots and land development.

An aerial survey of the entire area was conducted on May 29, 1975 by PEDCo-Environmental. Our observations confirmed the insignificance of these sources, as well as allowed inspection of fugitive dust sources in the bordering counties (Juab, Millard, and Tooele) which are included in the inventory. Figure 2-1 delineates the major fugitive dust locations within the study area, as observed and documented during the aerial survey. Copies of representative photographs taken during the aerial survey are presented and identified in Figure 2-2.

Estimates of fugitive dust emissions were made by employing emission factors developed in previous research projects, as described and referenced in the sections which

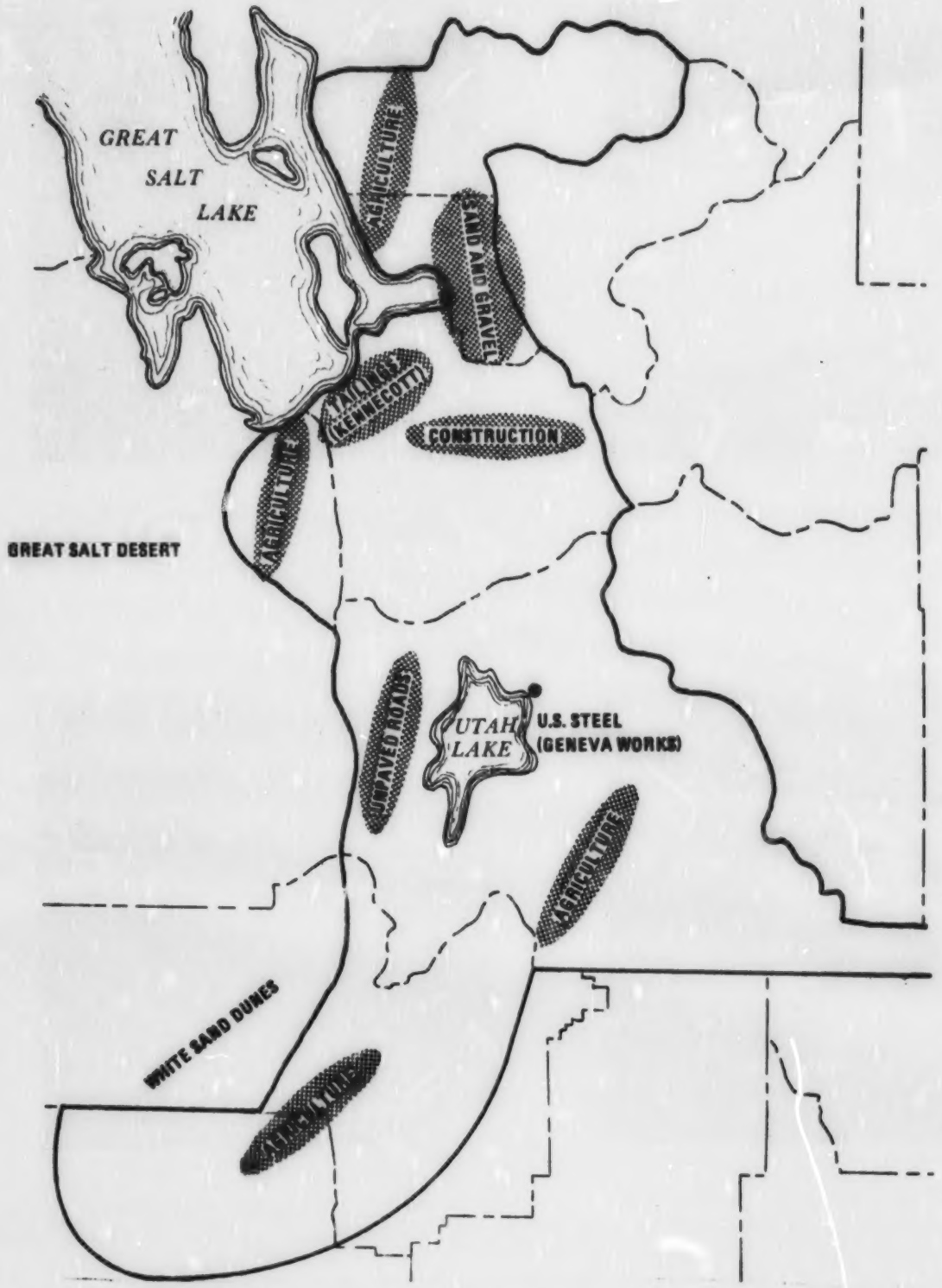
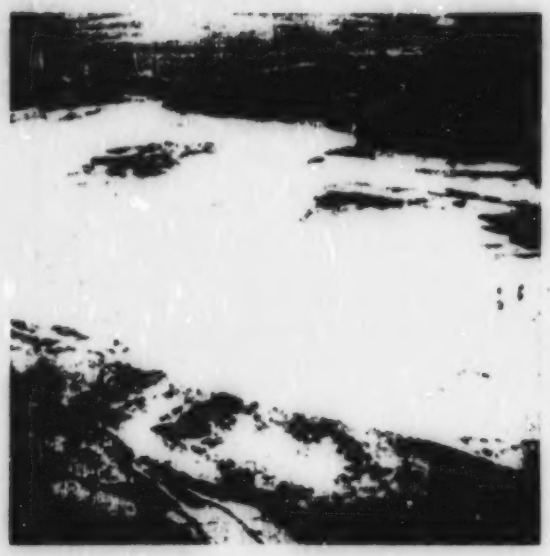
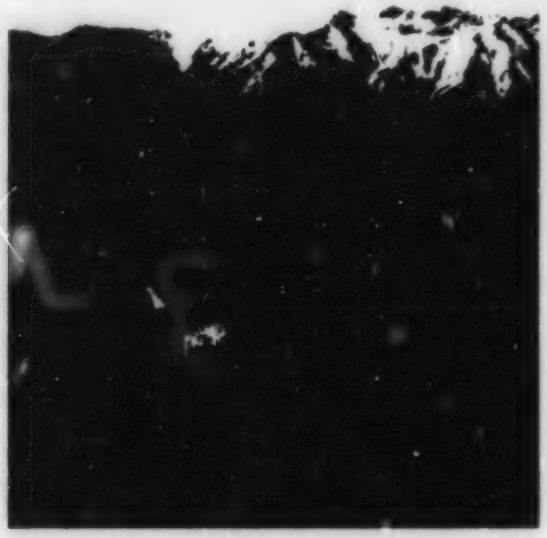


Figure 2-1. Major study area fugitive dust areas.



White Sand Dunes - Juab County



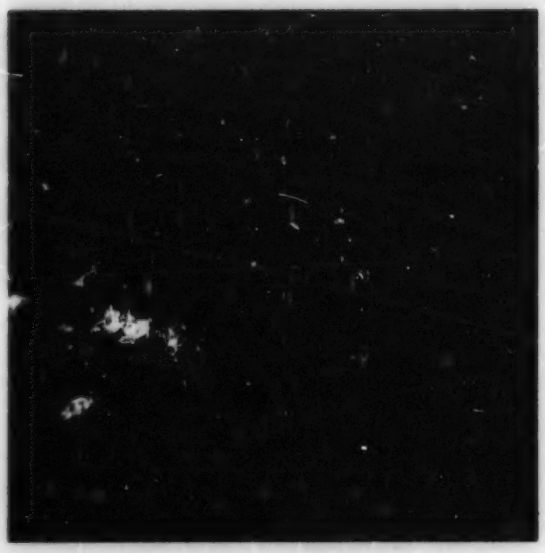
Mine tailings on West slope of Oquirrh Mountains

U.S. Steel Plant - Waste and Storage Piles, Geneva, Utah

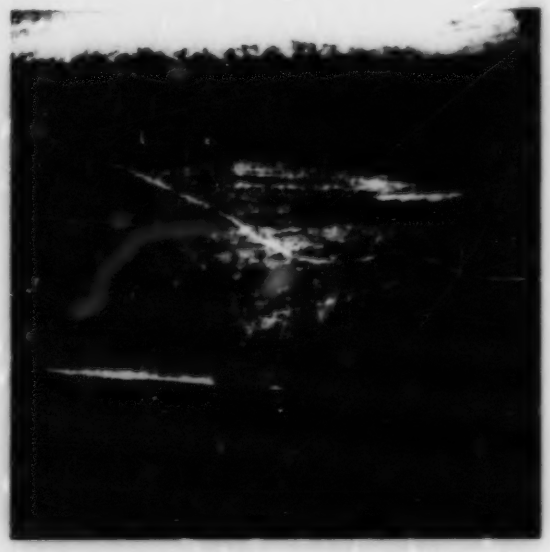
Construction area at Provo

Figure 2-2 Representative photographs of aerial survey.

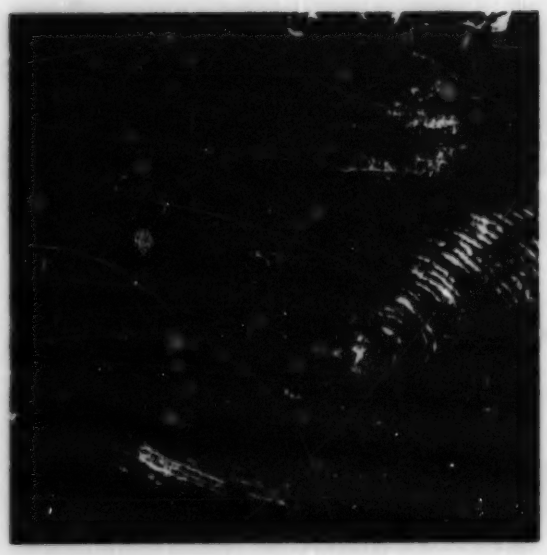
Agriculture near Santaquin in Southern Utah County



Unpaved roads on West shore of Lake Utah



Kenncott tailings pond



Kennecott Copper Mines - Tailings come from waste material from refining and smelting ore from this mine.

Figure 2-2(continued). Representative photographs of aerial survey.

follow. Estimates of the particulate emissions from the Great Salt Lake Desert area in Tooele County and the large sand dune area (White Sand Dunes) in Juab County were not possible because emission factors have not been developed for these naturally occurring sources. In addition, the relatively large particle size of the surface sand in both areas (fine sand particles are about 30 microns in diameter) should constrain their impact on the suspended airborne particulate (i.e. fugitive dust) of the Wasatch Front. However, due to its proximity and topography, the Great Salt Lake Desert area probably contributes in some degree to the background particulate ambient air quality of the study area.

SURVEY PROCEDURES

Descriptions of the estimating procedures and related emission factors for the eight fugitive dust source categories are presented in the following sections. The emission factors and source parameters for these categories are summarized in Table 2-1.

Agriculture

According to the 1974 Utah Agricultural Statistics[2] annual publication, only 4.1 percent of Utah's total land area is used as cropland. Yet, 25 percent of this two million acres of cropland is located within the study area. The aerial survey discussed previously showed a large

[2] Utah Agricultural Statistics 1974. Utah State Department of Agriculture, Salt Lake City Utah.

Table 2-1. SUMMARY OF EMISSION ESTIMATING PARAMETERS AND EMISSION FACTORS

UTAH FUGITIVE DUST STUDY

Source Category	Source Parameters	Data Obtained From	Emission Factor Information	
			Emission Factor	Reference
Agriculture	Soil type	Soil Conservation Service U.S. Dept. of Agriculture	Tilling (0.92 to 1.84 lb/acre)	Supplement No. 5 for Compilation of air Pollutant Emission Factors U.S. Environmental Protection Agency (EPA) April 1975
	Crop type			
	Acreage of crop type	Utah State Department of Agriculture	Windblown (16.0 to 256 lb/acre/yr)	
	Climatic conditions	Utah Guide for Wind Erosion Control on Cropland (U.S. SCS)		Development of Emission Factors for Fugitive Dust Sources (EPA) June 1974
Unpaved roads	Vehicle miles traveled	Utah State Dept. of Highways	(0.61 to 4.06 lb/-vehicles mile)	Supplement No. 5[4]
	(VMT) = miles of unpaved road x average daily traffic	Utah State Climatologist		
	Climatic conditions			
	Road surface silt content			
Tailings and industrial storage	Acres of tailings waste or storage	Utah State Ind. Commission	(0.64 to 4.0 ton/acre/-year)	Investigation of Fugitive Dust Vol. I Sources, Emissions and Control (EPA) June 1974
		Contact with individual plants		
	Climatic conditions	Utah Guide for Wind Erosion		
	Control methods			

Table 2-1 (continued). SUMMARY OF EMISSION ESTIMATING PARAMETERS AND EMISSION FACTORS

UTAH FUGITIVE DUST STUDY

Source Category	Source Parameters	Data Obtained From	Emission Factor Information	
			Emission Factor	Reference
Aggregate Storage	Tons of Aggregate Stored	Contact of Plant Operators	(2.17 lb/ton/year)	Development of Emission Factors for Fugitive Dust Sources (EPA) June 1974
Highway construction	Miles of highway under construction Months of construction	Utah State Department of Highways	(0.708 tons/acre/month)	Supplement No. 5
Residential/ industrial/- commercial- construction	Acres and months of construction	Systems Planning Division Utah State Department of Highway County Planning Commissions	(0.708 tons/acre/month)	Supplement No. 5
Sanding for ice and snow control	Vehicle miles traveled (VMT) Number of days with sanding material on road.	Utah State Department of Highway Engineering departments of major cities	(0.17 lb/VMT)	Investigation of Fugitive Dust - Colorado

amount of agricultural activity in a two hundred square mile area in northeastern Tooele County, Juab County east of U.S. Route 50, and northeast Millard County. These areas were included in the study because of their close proximity and related impact on the Wasatch Front.

Agricultural emissions come from two major sources: tilling operations of farm implements and wind blowing across cultivated fields. Only acreages of field crops such as oats, potatoes, corn, barley, wheat and sugar beets were considered in estimating fugitive dust emissions.

In determining emissions from tilling operations, the acreage[2] of field crops for each county was employed with emission factors per acre tilled which were derived from an empirical equation in Supplement No. 5 to Compilation of Air Pollutant Emission Factors.[3] A correction factor of 0.8 was applied to the emission factor so that the emission inventory only accounted for that portion of emissions less than 30 microns in diameter. Total agricultural emissions from tilling for the study area were estimated to be 72 ton/yr.

In determining emissions from wind erosion across agricultural fields, the acreage of each crop type previously mentioned had to be considered separately. An empirical equation obtained from the EPA report "Development of Emis-

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[3] Supplement No. 5 to Compilation of Air Pollutant Emission Factors, Second Edition. U.S. EPA, Office of Air Quality and Standards. Research Triangle Park, North Carolina April 1975.

sion Factors for Fugitive Dust Sources"[4] was used in determining the emission factors. This equation is a simplified version of the wind erosion equation developed to predict topsoil losses. The emission factors calculated (0.008 to 0.128 ton/acre/yr) were then applied to the appropriate crop acreages to determine the emissions produced, yielding a study area total of 666 ton/yr.

Projected total emissions from agriculture in the study area for 1980 and 1985 are 724 and 710 ton/yr, respectively. These projections were exprapolated based on the historical trend of total agricultural acreage for Utah from the publication "Utah Agricultural Statistics 1974." Decreases for 1980 and 1985, amounted to 1.9 and 3.8 percent, respectively, as compared to 1974 acreage.

Unpaved Roads

Unpaved roads were observed throughout the study area. Dust emissions from vehicles traveling on these roads have been investigated and tested in previous studies.[3,4,5] The unpaved roads were divided into four types: gravel, graded, unimproved, and primitive. Emissions for each type were determined separately and then combined for each county.

The emission factors for each county and road type were derived from an empirical equation.[3] These emission factors

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[4] Development of Emission Factors for Fugitive Dust Sources. U.S. Environmental Protection Agency. Research Triangle Park, N. C. Publication No. 450-3-7-037. June 1974.

[5] Investigation of Fugitive Dust - Sources, Emissions, and Control. Prepared for EPA, Contract No. 68-02-0044, Task No. 9. PEDCo-Environmental Specialists, Inc. May 1973.

were then adjusted to account for variations in climatic conditions throughout the study area (a climatic factor, "C", based on average wind speed and rainfall, of 0.20 existed throughout most of the study area).

County-wide emissions for each road type are the product of the vehicle-miles traveled (VMT),[6,7] and the corrected emission factors. Total study area emissions from unpaved roads were estimated to be 6570 ton/yr.

Tailings

The aerial survey pinpointed six areas where tailings piles existed. Later conversations with Utah State Industrial Commission personnel verified these findings and estimated the total acreage at 5047 acres. Of this total acreage, 5000 acres were encompassed by a tailings pond which Kennecott Copper Company is presently operating. A large part of this operating pond is wet, leaving only 20 percent or 1000 acres remaining dry (Dr. B. Heaney, Kennecott Copper Co., personal communication, June 17, 1975). Periodic aerial spraying with hygroscopic substances have been conducted to control dust from the dry areas. Observations made under wind conditions greater than 20 mph (A. Wisbith, PEDCo-Environmental, personal observation, June 17, 1975) showed that while most of the dry area was stable, a

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[6] Systems Planning Division, Utal State Department of Highways, Salt Lake City, Utah.

[7] Major E. Elmer, State Maintenance Officer, Utah National Guard, Salt Lake City, Utah, phone conversation.

large amount of dust was seen blowing from areas where the protective surface had been disturbed by vehicular traffic.

Fugitive dust emissions from tailings were determined by applying an emission factor[5] of 2.7 ton/acre. This value was corrected by a factor of 0.2 for active ponds to account for dust control measures and wetted areas. It was estimated that active and inactive tailings ponds account for 2830 tons of fugitive dust each year in the study area.

Aggregate Storage

A natural abundance of sand and gravel at what had been the shoreline of old Lake Bonneville attributes to the large number of sand and gravel companies in the survey area. Most companies stockpile their material during months of low construction activities in anticipation of later increases in volume. Airborne dust is generated by wind blowing across the surface of these stock piles. In order to obtain an accurate estimate of the dust produced, it was necessary to determine the amount of aggregate materials normally stored throughout the year. A list of companies was compiled from the Directory of Utah Manufacturers[8] and local telephone books. Questionnaires were mailed to 20 of the companies listed requesting the quantity of material stored and methods of dust control that were employed. A follow-up phone call was made to each of the selected companies to assure a prompt response. To account for those companies

[8] Directory of Utah Manufacturers, Utah Department of Employment Security, Salt Lake City, Utah.

not contacted, an average quantity stored (determined from the collected data) was applied.

The emission factor (2.17 lb/ton)[4] was applied to the amount of material stored to yield the estimates of individual county emissions from these sources. Total emissions from aggregate storage for the study area were estimated to be 2735 ton/yr.

Industrial Storage

Two other major storage pile areas that were noted in the aerial survey were the slag pile area at Kennecott Copper and the storage pile area at the U.S. Steel's Geneva Works on the east shore of Utah Lake.

The active slag pile at Kennecott covers 86 acres but consists of very stable material. Observations made under wind conditions greater than 20 mph showed that the amount of wind-blown dust produced from the pile was insignificant. Therefore, this area was not included in the emission estimates.

The storage pile areas at U.S. Steel consist of a variety of both raw and waste materials in various sized piles. In order to obtain an accurate estimate of the potential fugitive dust emissions, a plant visit was made. The area of individual piles was estimated from aerial photographs provided by company personnel. A visit to the storage area was also undertaken to determine dust potentials of the various materials.

Two emission factors (3.5 and 10.4 lb/acre/day)[4] were employed depending on storage pile characteristics. These values were adjusted for each of the material types stored. It was estimated that storage pile emissions from the U.S. Steel plant were 22 ton/yr.

Highway Construction

A limited amount of highway construction was in progress during 1974, since the interstate highway system in the Salt Lake City area was nearly complete. The mileage of highways in each county along with the months of construction during 1974 were obtained from the Construction Office of the State Department of Highways (S. Van Orman, May 28, 1975, personal communication). An emission factor of 0.708 ton/acre/month[3] was employed to estimate the emissions from this source. The emission factors take into account the climatic factor for the study area. It was estimated that a total of 3338 tons in 1974 were generated from highway construction.

Residential-Commercial/Industrial Construction

Federal construction projects other than highway construction activities were included with commercial/industrial construction. The acreage under construction for each category was obtained from the Systems Planning Division of the Utah State Department of Highways[9] and the following

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[9] Salt Lake Transportation Study, System Planning Division, Utah State Department of Highways.

government agencies:

District Officer, Bureau of Land Management
Design and Construction Division, Bureau of Reclamation
Director, Utah Wildlife Resources Division
State Maintenance Officer, Utah National Guard

The total acreage reported for each county was reduced to an amount estimated to reflect the actual area disturbed by the construction activities.

Conversations with personnel for each of the county planning commissions revealed that: one-half of the residential acreage would probably be disturbed during construction; most residential construction is completed within three months; all commercial/industrial acreage is usually disturbed during construction but that the dust producing phase is usually completed within six months. Based on these estimates, the number of acre-months of each construction type was determined, and an emission factor of 0.708 ton/acre/month was employed to estimate emissions. Total estimated annual emissions were 12,417 tons of dust in 1974.

Sanding (Ice and Snow Control)

Sand and/or other materials used for ice and snow control often remain on curbed roads after melting occurs. The subsequent mechanical grinding by vehicular traffic produces a substantial amount of dust for a few days until the material is washed or blown from the road.

The mileage of curbed streets which are sanded annually for snow control and vehicle-mile data for these streets

were estimated from data obtained from study area highway engineering departments. Based on an average snowfall frequency (of one inch or more) of 25 days per year (F.R. Van Houten, Utah State Department of Highways) and an average of two days of dust producing conditions after each snowfall, the dust produced from this source was estimated by applying an emission factor of 0.17 lb/vehicle-mile[10] to the vehicle-miles for each county. Total annual emissions from snow control from the study area were estimated to be 4848 tons.

SURVEY DATA

The raw data were collected and logged in tabular form by source category for each county. This provided uniformity and rapid comparison of relative source activity levels. The data notebook is available in the project files. County and study area totals of the appropriate source parameters are summarized in Table 2-2.

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[10] Investigation of Fugitive Dust - Sources, Emissions, and Control - For Attainment of Secondary Ambient Air Quality Standards - Colorado. Prepared for EPA, Contract No. 16, PEDCo-Environmental Specialists, Inc., November 1973.

Table 2-2. FUGITIVE DUST EMISSION SOURCE PARAMETERS

BY SOURCE CATEGORY AND COUNTY 1974

Source category	Source paramterer	Weber	Davis	Salt Lake	Utah	Tooele	Juab	Millard
Agriculture	Total acreage emitting fugitive dust	8,980	9,022	22,740	29,138	6,322	22,872	20,263
Unpaved roads	Vehicle miles per day	4,834	3,622	13,958	13,799	165	964	1,278
Tailings and industrial storage	Acres of tailings, waste, and storage			5,030	22	15	1	1.5
Aggregate storage	Tons of aggregate	302,948	229,461	1,453,253	535,409			
Highway construction	Acres of highway under construction	58	Neg.	278	12	Neg.	255	Neg.
Residential industrial/ commercial construction	Acres under construction	122	192	3,458	291			
Sanding for ice and snow control	Vehicle miles per day	175,000	106,650	633,900	225,500			

REFERENCES

1. "State of Utah Compilation of NEDS Data," prepared for U.S. EPA Region VIII, Contract No. 68-02-1006, Task No. 2 GCA/Technology Division, December 1973.

2. Utah Agricultural Statistics 1974, Utah State Department of Agriculture, Salt Lake City, Utah.

3. Supplement No. 5 to Compilation of Air Pollutant Emission Factors, Second Edition, U.S. EPA, Office of Air Quality Planning and Standards Research Triangle Park, N. C., April 1975.

4. Development of Emission Factors for Fugitive Dust Sources. U.S. Environmental Protection Agency. Publication No. 450-3-74-037. Research Triangle Park, North Carolina. June, 1974.

5. Investigation of Fugitive Dust - Sources, Emissions and Control. Prepared for EPA, Contract No. 68-02-0044, Task Order No. 9. PEDCo-Environmental Specialists, Inc., May, 1973.

6. Systems Planning Division, Utah State Department of Highways, Salt Lake City, Utah.

7. State Maintenance Officer, Utah National Guard, Salt Lake City, Utah. Phone conversation - Major E. Elmer.

8. Directory of Utah Manufacturers, Utah Department of Employment Security, Salt Lake City, Utah.

9. Salt Lake Transportation Study, System Planning Division, Utah State Department of Highways.

10. Investigation of Fugitive Dust - Sources, Emissions, and Control - For Attainment of Secondary Ambient Air Quality Standards - Colorado. Prepared for EPA, Contract No. 16, PEDCo-Environmental Specialists, Inc., November 1973.